

preferably having an average fiber diameter of 0.3 to 1  $\mu\text{m}$  and an average fiber length of 10 to 30  $\mu\text{m}$  relative to 100 parts by mass of a base resin.

Page 7, in the paragraph beginning at line 24 through page 8, line 2, please replace as follows:

In the present invention, an insulating substrate may be composed of a core layer and a superficial layer containing a fibrous filler and covering the surface of a core layer, and a metal layer may be formed on the surface of this superficial layer.

Page 8, in the paragraph beginning at line 3, please replace as follows:

In addition, in the present invention, an unshaped powdery filler may be contained in a core layer of an insulating substrate.

Page 8, in the paragraph beginning at line 5, please replace as follows:

In addition, in the present invention, an insulating substrate may contain a fibrous filler and may be constructed such that a plurality of resin layers in which a fibrous filler is oriented in a different direction are laminated.

Page 8, in the paragraph beginning at line 9, please replace as follows:

In addition, the present invention may be constructed such that orientation directions of fibrous fillers in resin layers are approximately orthogonal to orientation directions of fibrous fillers in the adjacent other resin layers.

Page 8, in the paragraph beginning at line 13, please replace as follows:

In addition, the present invention may be formed by injection-molding respective resin layers.

Page 8, in the section title and subsequent paragraph beginning at line 15, through page 9, line 4, please delete in their entirety.

Page 10, in the paragraph beginning at line 24, please replace as follows:

When a resin composition containing melt-type liquid crystal polyester as a base resin is used, an insulating substrate can be formed by general injection molding. However, a resin composition injected into a mold for molding at molding undergoes the strong shearing force near an inner wall of a mold for molding and, as a result, a skin layer in which orientation directions of a resin are the same is formed on a superficial layer of an insulating substrate and, on the other hand, in its inner layer, the directions of fibers are not the same. This skin layer is also formed upon injection molding using other resins. However, when rigid melt-type liquid crystal polyester is used, a more highly oriented skin layer is formed. For this reason, a skin layer of an insulating substrate has anisotropy such that it has usually the extremely high mechanical strength and elasticity in a flowing direction of a resin composition (orientation direction of a resin) upon molding but becomes weak in a direction orthogonal to this flowing direction. However, since a filler described below is contained in a resin composition in the present invention, the strength of a skin layer is improved and, as a result, the better molding processibility, the thermal resistance and the dimensional stability are imparted to an insulating substrate and, at the same time, the adherability between an insulating substrate and a metal layer can be improved.

Page 11, in the paragraph beginning at line 20, please replace as follows:

In addition, by using 2 or more resins as a base resin, the properties of an insulating substrate can be improved as compared with the case of the use of one kind of resin. For example, when a resin containing 100 parts by mass of tri(phthalamide) and 25 parts by mass of polyphenylene sulfide is used as a base resin, the adherability between an insulating substrate and a metal layer can be improved as compared with the case where only polyphthalamide is used as a base resin. In addition, in such a case, the adherability can be also improved when the thermal load is added to a laminate (see Examples 19 and 20 below).

Here, it is preferable that, as a resin to be added to a resin as a main component in a base resin, a resin having the better adherability than that of a main component, a resin having the small linear expansion coefficient, and a resin having the excellent mechanical properties are used.

Page 12, in the paragraph beginning at line 8, please replace as follows:

On the other hand, as a filler, a fibrous filler having an average fiber diameter of 0.1 to 5  $\mu\text{m}$  and an average fiber length of 10 to 50  $\mu\text{m}$  is used alone, or it is used together with at least any one of an unshaped powdery filler having an average particle size of 0.1 to 20  $\mu\text{m}$  and a spherical filler having an average particle size of 0.1 to 20  $\mu\text{m}$ .

Page 12, in the paragraph beginning at line 13, please replace as follows:

As a fibrous filler, silicon carbide, silicon nitride, zinc oxide, alumina, calcium titanate, potassium titanate, barium titanate, aluminium borate, calcium silicate, magnesium borate, calcium carbonate, magnesium oxysulfate, wallastonite and the like can be used. In particular, when titanate such as potassium titanate, calcium titanate and barium titanate is used, the strength of a superficial layer of an insulating substrate can be improved and the adherability between an insulating substrate and a metal layer can be improved and, in addition, dielectric loss factor of an insulating substrate can be reduced and, at the same time, dielectric constant can be controlled in a broader range. In addition, when borate such as aluminium borate and magnesium borate is used, since the linear expansion coefficient of a filler is small, the linear expansion coefficient-reducing effects of an insulating substrate due to filling of a filler becomes very high and, a stress loaded to packaged parts such as IC chip and the like is reduced when a laminate is used for a resin-molded circuit substrate and accumulation of stress in packaged parts is suppressed and, thus, erroneous operation such as

occurrence of the noise from the interior of packaged parts and damage of packaged parts can be prevented.

Page 13, in the paragraph beginning at line 6, please replace as follows:

When an average fiber diameter of this fibrous filler is below  $0.1\ \mu\text{m}$ , the strength of a fibrous filler is lowered and, as a result, a fibrous filler is damaged by shearing when a base resin and a fibrous filler are kneaded upon preparation of a resin composition, or at molding of a resin composition into an insulating substrate, resulting in the cause for scatter of the physical properties of an insulating substrate. In addition, aggregation tends to be produced due to charge harbored by a fibrous filler and it becomes difficult to disperse a fibrous filler uniformly.

Page 13, in the paragraph beginning at line 14, please replace as follows:

Conversely, when an average fiber diameter of a fibrous filler exceeds  $5\ \mu\text{m}$ , an amount of a fibrous filler to be filled in a resin composition is at a low level, exceeding the limit amount, and an amount of fibers per unit volume of a fibrous filler in a resin composition and an insulating substrate is lowered. As a result, a difference in the thermal expansion coefficient and shrinkage coefficient between a part where a fibrous filler is present and a part where a fibrous filler is not present in a resin composition and an insulating substrate becomes larger, the smoothness of an insulating substrate is deteriorated, and the smoothness of a metal layer formed on the surface of an insulating substrate is also deteriorated. Thus, the connectability of a wire at wire bonding of packaged parts such as IC chip and the like is deteriorated when a laminate is used for a resin-molded circuit substrate.

Page 14, in the paragraph beginning at line 2, please replace as follows:

In addition, when an average fiber length of a fibrous filler is below  $10\ \mu\text{m}$ , the mechanical properties and thermal properties of a resin composition and an insulating

substrate are improved to a certain degree, but insufficient and, for this reason, an insulating substrate is expanded or constricted by the thermal load applied to a laminate in a manufacturing step or the thermal load due to change in the environmental temperature, the adherability between an insulating substrate and a metal layer is reduced, a stress loaded to packaged parts such as IC and the like becomes larger and, as a result, a resistance value in the interior of packaged parts is changed, resulting in the cause for occurrence of the noises, or damage of packaged parts.

Page 14, in the paragraph beginning at line 13, please replace as follows:

Conversely, when an average fiber length of a fibrous filler exceeds  $50\text{ }\mu\text{m}$ , the strength of a fibrous filler is apparently reduced and, as a result, a fibrous filler is damaged by the shearing force when a base resin and a fibrous filler are kneaded upon preparation of a resin composition, or at molding of a resin composition into an insulating substrate, resulting in the cause for scatter of the physical properties of an insulating substrate. In addition, an amount of a fibrous filler to be filled in a resin composition is at a low level, exceeding the limit amount, an amount of fibers per unit volume of a fibrous filler in a resin composition and an insulating substrate is reduced, and the number of fibers in a superficial layer of an insulating substrate. In this case, there is a possibility that the better adherability is not obtained due to occurrence of stress concentration in fibers when broken near an interface between an insulating substrate and a metal layer. In addition, at molding into an insulating substrate, fibers tend to be oriented in a direction of injection of a resin composition (flowing direction) upon injection of a resin composition into a mold. There arises a difference in concentration of breaking stress between an orientation direction of fibers and a direction orthogonal to this direction and, there is a possibility that anisotropy occurs in the adherability between an insulating substrate and a metal layer. Further, as the content of a

filler grows smaller, the fiber density per unit volume and, as a result, a difference in the thermal expansion coefficient and shrinkage between a part wherein a fibrous filler is present and a part where a fibrous filler is not present in a resin composition and an insulating substrate becomes larger, the surface smoothness is deteriorated at molding into an insulating substrate, the smoothness of an insulating substrate is deteriorated and, as a result, the connectability of a wire at wire bonding of packaged parts such as IC chip and the like is deteriorated when a laminate is used for a resin-molded circuit substrate.

Page 15, in the paragraph beginning at line 17, please replace as follows:

In addition, when only a fibrous filler is used as a filler, the content of a fibrous filler in a resin composition is 20 to 150 parts by mass relative to 100 parts by mass of a base resin. In this case, the adherability between an insulating substrate and a metal layer can be further improved, an amount of the dimensional change when the thermal load is applied can be further reduced to decrease a stress loaded to packaged parts such as IC chip and the like, and occurrence of the noise from or of packaged parts can be prevented.

Page 15, in the paragraph beginning at the last line, please replace as follows:

When the content of a fibrous filler relative to 100 parts by mass of a base resin is below 20 parts by mass, the linear expansion coefficient of an insulating substrate is increased, leading to deterioration of the dimensional stability. And, a stress loaded to packaged parts is increased when the thermal load is applied, and there is a possibility that the noises occur from packaged parts, or packaged parts are damaged. In addition, when the content exceeds 150 parts by mass, a filler tends to be exposed on the surface of an insulating substrate and, when the affinity between a fibrous filler and a metal layer is low, an interface between a fibrous filler and a metal layer is easily peeled, there is a possibility that the adherability between an insulating substrate and a metal layer is lowered. In addition, even when the

affinity between a fibrous filler and a metal layer is high, there is a possibility that the adherability between an insulating substrate and a metal layer is apparently lowered by breakage of an interface between the resin phase and a fibrous filler in an insulating substrate on the surface of an insulating substrate. Further, when this content exceeds 150 parts by mass, it becomes difficult to pelletize a resin composition using an extruder before molded into an insulating substrate, or an insulating substrate molded from a resin composition becomes fragile and it becomes difficult to use as a circuit substrate.

Page 16, in the paragraph beginning at line 21, please replace as follows:

In addition, when an unshaped powdery filler is used as a filler, zinc oxide, magnesium oxide, iron oxide, titanium oxide, aluminium borate, alumina, silica, calcium carbonate, calcium silicate, talc, mica, kaolin, graphite powder, carbon black, glass and the like can be used. When such an unshaped powdery filler is used, orientation of fillers at molding can be suppressed and, thus, occurrence of anisotropy of the properties of an insulating substrate molded from a resin composition can be suppressed. In particular, when borate such as aluminium borate, magnesium borate and the like is used, since the linear expansion coefficient of a filler is small, the linear expansion coefficient-reducing effects of an insulating substrate by filling of a filler becomes very high and, thus, erroneous operation such as occurrence of the noises from packaged parts such as IC and the like packaged to a laminate or damage of packaged parts can be further suppressed.

Page 17, in the paragraph beginning at line 10, please replace as follows:

When an average particle size of this unshaped powdery filler is below  $0.1\ \mu\text{m}$ , aggregated masses tend to be produced on the surface due to distribution failure when a resin composition is molded into a pellet-like molded material using an extruder before molded into an insulating substrate, and it becomes difficult to obtain a molded material, or an

insulating substrate molded from a resin composition becomes fragile, and it becomes difficult to use as a circuit substrate.

Page 18, in the paragraph beginning at line 1, please replace as follows:

When borate such as aluminium borate, magnesium borate and the like is used as an unshaped powdery filler, since the linear expansion coefficient of a filler is small, the linear expansion coefficient reducing effects of an insulating substrate by filling of a filler becomes very high and, thus, erroneous operation such as occurrence of the noises from packaged parts such as IC and the like packaging to a laminate or damage of packaged parts can be further suppressed.

Page 18, in the paragraph beginning at line 8, please replace as follows:

As a spherical filler, alumina, silica, aluminium silicate and the like can be used. When such a spherical filler is used, orientation of fillers at molding can be suppressed, and occurrence of anisotropy of the properties such as the adherability, the strength and the like of an insulating substrate molded from a resin composition can be suppressed. In particular, when silica is used as a spherical filler, since the linear expansion coefficient of a filler is small, the linear expansion coefficient-reducing effects of an insulating substrate by filling a filler becomes very high and, thus, erroneous operation such as occurrence of the noises from packaged parts such as IC and the like packaged to a laminate or damage of packaged parts can be further suppressed.

Page 18, in the paragraph beginning at line 19, please replace as follows:

When an average particle size of this spherical filler is below  $0.1\ \mu\text{m}$ , aggregated masses tend to be produced on the surface due to distribution failure when a resin composition is molded into a pellet-like molded material using an extruder before molded into an insulating substrate, and it becomes difficult to obtain a molded material, or an



insulating substrate molded from a resin composition becomes fragile, and it becomes difficult to use as a circuit substrate in some cases.

Page 19, in the paragraph beginning at line 21, please replace as follows:

More particularly, even when an amount of a filler relative to 100 parts by mass of a base resin in a resin composition is 400 parts by mass, a stable resin composition can be obtained and, at the same time, a stable insulating substrate can be molded from this resin composition. Like this, since a filler can be filled at a high density, the effects of decreasing the linear expansion coefficient of an insulating substrate become very high due to filling of a filler, and erroneous operation such as occurrence of the noises from packaged parts such as IC chip and the like packaged to a laminate or occurrence of damage of packaged parts can be further suppressed.

Page 20, in the paragraph beginning at line 6, please replace as follows:

In addition, it is preferable that, as a fibrous filler as a filler, an unshaped powdery filler and a spherical filler are used together. When a fibrous filler is used as a filler, when a resin composition is injected into a mold for molding and hardened or solidified to mold an insulating substrate, fibrous fillers tend to be oriented along a resin flowing direction (injection direction). For that reason, there arises anisotropy in the properties such as the strength, the linear expansion coefficient and the like between this direction and a transverse direction or a thickness direction orthogonal thereto. To the contrary, by using an unshaped powdery filler and a spherical filler together, occurrence of a difference in the properties such as the linear expansion coefficient and the like between a resin flowing direction and a direction orthogonal thereto can be suppressed and occurrence of anisotropy in expansion and constriction can be suppressed when the thermal load is applied to a laminate, occurrence of distribution of stress concentration manner at an interface between a metal layer and an

insulating substrate is suppressed in the resin flowing direction and in a direction orthogonal thereto, and occurrence of anisotropy in the adherability between an insulating substrate and a metal layer can be prevented.

Page 20, in the paragraph beginning at the last line, please replace as follows:

Here, when a fibrous filler and a powdery filler are used together, a powdery filler is used preferably at 50 to 150 parts by mass, more preferably 100 parts by mass relative to 100 parts by mass of a fibrous filler. In this case, a total amount of fillers relative to 100 parts by mass of a base resin in a resin composition is preferably 50 to 100 parts by mass, more preferably 100 parts by mass.

Page 21, in the paragraph beginning at line 6, please replace as follows:

In addition, when a fibrous filler and a spherical filler are used together, a spherical filler is used preferably at 50 to 150 parts by mass, more preferably 100 parts by mass relative to 100 parts by mass of a fibrous filler. In this case, a total amount of fillers relative to 100 parts by mass of a base resin in a resin composition is preferably 50 to 150 parts by mass, more preferably 100 parts by mass.

Page 21, in the paragraph beginning at line 12, please replace as follows:

Upon manufacturing of an insulating substrate, the aforementioned base resin and fillers are mixed and kneaded to prepare a resin composition, which is, if needed, molded into a pellet using an extruder or the like to obtain a molded material. This resin composition or molded material is molded using a mold by injection molding or the like, to prepare an insulating substrate.

Page 21, in the paragraph beginning at line 18, please replace as follows:

The surface of this insulating substrate is activated by the plasma treatment. More particularly, a pair of electrodes are arranged at upper and lower positions in a chamber and,

at the same time, a high frequency source is connected to one electrode and other electrode is earthed. Between electrodes of a plasma treating apparatus thus constructed, an insulating substrate is arranged on an electrode. In this state, the chamber is evacuated to reduce pressure below  $10^{-4}$  Pa and, thereafter, an active gas such as  $N_2$ ,  $O_2$  or the like is flown into the chamber and, at the same time, the gas pressure in the chamber is controlled at 8 to 15 Pa. Next, the high frequency of 13.56 Hz is applied to an electrode with a high frequency source for 10 to 100 seconds. Upon this, an active gas in a chamber is excited by discharge between electrodes to generate the plasma and, thereby, a cation and radical are formed. These cation and radical are collided against the surface of an insulating substrate to chemically activate the surface of an insulating substrate. In particular, by induced collusion of a cation against an insulating substrate, oxygen polar groups and nitrogen polar groups which easily bind to a metal are introduced on the surface of an insulating substrate and, thereby, the adherability to a metal layer is improved. The plasma treating conditions are not limited to the aforementioned ones but can be performed in such a range that the surface of an insulating substrate can be activated. And the plasma treatment is performed in such a range that the surface of an insulating substrate is not excessively roughened in this plasma treatment process.

Page 22, in the paragraph beginning at line 18, please replace as follows:

Then, a metal layer is formed on the surface of an insulating substrate activated by the aforementioned plasma treatment, by any one method of sputtering, vacuum deposition and ion plating in continuous process without opening to the atmosphere. Thereby, a metal layer and an insulating substrate become to have the high adherability by oxygen polar groups and nitrogen polar groups on the surface of an insulating substrate. Here, a metal layer can be

formed of a simple substance metal or an alloy such as nickel, gold, aluminium, titanium, molybdenum, chromium, tungsten, tin, lead, brass, NiCr and the like.

Page 23, in the paragraph beginning at line 2, please replace as follows:

When sputtering is performed, the DC sputtering format can be applied. In this case, for example, after an insulating substrate is arranged in a chamber, the chamber is evacuated to below a pressure of  $10^{-4}$  Pa using a vacuum pump. In this state, an inert gas such as argon or the like is introduced into a chamber to a gas pressure of 0.1 Pa. Further, application of 500 V direct voltage, a copper target is bombarded to form a copper layer having a thickness of 300 to 500 nm.

Page 23, in the paragraph beginning at line 18, please replace as follows:

In case when an ion plating is conducted, a crucible in which copper is placed as a material is arranged in the chamber, and, at the same time, an induced antenna part is placed between the insulating substance and the crucible in the chamber. In this state, after the chamber is evacuated to a pressure below  $10^{-4}$  Pa, acceleration voltage 10 kV is applied to generate a 400 to 800 mA electron flow, which is collided against a material in the crucible to heat it. Thereby, a material in a crucible is vaporized. Then, an inert gas such as argon or the like is introduced in the induced antenna part so that a gas pressure becomes 0.05 to 0.1 Pa. A 13.56 MHz high frequency with output 500 W is applied to this induced antenna to generate the plasma. On the other hand, a 100 to 500 V direct voltage is applied to an insulating substrate as a bias voltage. Thereby, a copper layer having a thickness of 300 to 500 nm can be formed.

Page 24, in the paragraph beginning at line 6, please replace as follows:

A fine circuit is formed on the thus formed metal layer of a laminate by a laser method. That is, the laser light is illuminated to a border between a circuit-formed part and a

non-circuit-formed part to remove a metal in this border part, and a circuit-formed part is subjected to electrolytic plating. Then, the soft etching treatment is performed to remove a metal at a non-circuit-formed part, leaving a metal at a circuit-formed part and, thereby, a circuit having the desired pattern can be formed to obtain a resin-formed circuit substrate.

Page 24, in the paragraph beginning at line 14, please replace as follows:

In the thus obtained laminate, a filler is sufficiently distributed also in a superficial layer of an insulating substrate, the strength of a superficial layer of an insulating substrate is microscopically improved remarkably and, at the same time, uniformity of the interior of an insulating substrate is obtained, improving the adherability between an insulating substrate and a metal layer. In addition, improvement in the distributing properties of a filler in an insulating substrate can reduce the linear expansion coefficient in an insulating substrate. For that reason, when a laminate is used as a circuit substrate, occurrence of the thermal stress at an interface due to a difference in linear expansion coefficients between an insulating substrate and a metal layer is suppressed when receiving a variety of thermal loads at a manufacturing steps, and environmental test or the actual use environment, and decrease in the adhering strength between an insulating substrate and a metal layer can be suppressed when a laminate undergoes the thermal load. In addition, change in the shape of a laminate can be suppressed when a laminate receives such the thermal load, and accumulation of a stress in packaged parts can be suppressed and erroneous operation such as occurrence of the noises due to change in a resistance value in packaged parts and damage of packaged parts can be prevented.

Page 25, in the paragraph beginning at line 9, please replace as follows:

In addition, since the surface of an insulating substrate does not need to be subjected to roughing upon formation of a metal layer and change in the shape when receives the

thermal load is suppressed, a metal layer has the excellent surface smoothness. For that reason, the reliance of connection of elements to circuits can be improved when a laminate is used as a resin-molded circuit substrate, packaged parts are connected by wire bonding, or packaged by the flip chip manner. In particular, the great effects can be obtained in flip chip packaging where the high surface smoothness is required.

Page 25, in the paragraph beginning at line 18, please replace as follows:

Further, since a metal layer has the excellent surface smoothness, when a circuit is formed on a laminate, it enables to make a very fine circuit. For example, it is possible to form a fine pattern having a line width of 0.03 mm, a line spacing of 0.03 mm (Line width=0.03 mm, Space width=0.03 mm).

Page 25, in the paragraph beginning at line 23, please replace as follows:

Alternatively, upon preparation of an insulating substrate, an insulating substrate is constructed to consist of a superficial layer containing a fibrous filler arranged in a superficial layer and a core layer containing no fibrous filler, and a metal layer may be formed on the surface of a superficial layer. Upon this, a superficial layer may be formed on only one side on which a metal layer is to be formed, of surface and back sides of a core layer. Alternatively, superficial layers may be on the entire surface of a core layer. In this case, an amount of a more expensive fibrous filler than an unshaped powdery filler can be reduced to save the manufacturing cost and, at the same time, the adherability between an insulating substrate and a metal layer can be maintained. Upon this, a filler dose not need to be incorporated into a core layer. However, when an unshaped powdery filler is incorporated into a core layer, the rigidity of the entire insulating substrate can be improved and, at the same time, the linear expansion coefficient of the entire insulating substrate can be reduced and, further, occurrence of anisotropy in the properties such as the strength, the linear

expansion coefficient and the like due to orientation of fibrous fillers can be suppressed to further improve the adherability between a metal layer and an insulating substrate and, at the same time, application of a stress load to loaded parts such as IC and the like can be suppressed to prevent occurrence of the noises from and damage of loaded parts.

Page 26, in the paragraph beginning at line 20, please replace as follows:

Upon preparation of an insulating substrate consisting of such the core layer and the superficial layer, a superficial layer may be formed on a core layer by a coating method, or a core layer and a superficial layer may be formed simultaneously.

Page 26, in the paragraph beginning at line 24, please replace as follows:

When a coating method is applied, after a resin composition containing no filler or a resin composition containing an unshaped powdery filler is molded by molding such as injection molding or the like, a paint containing a fibrous filler can be coated thereon. This paint can be prepared by dispersing or dissolving a resin composition containing a fibrous filler and this paint can be coated by a method such as a spin coating dipping method or the like.

Page 27, in the paragraph beginning at line 6, please replace as follows:

Alternatively, an insulating substrate can be obtained by laminating a plurality of resin layers which is formed of a resin composition containing a fibrous filler, and in which fibrous fillers are oriented at the same direction. In this case, orientation directions of fibrous fillers in each of resin layers are made to be different between adjacent resin layers. For example, three layers of resin layers are laminated to prepare an insulating substrate and, in this case, fibrous fillers in the second layer of a resin layer are oriented in a direction at 45° relative to an orientation direction of fibrous fillers in the first layer of a resin layer and,

further fibrous fillers of the third layer of a resin layer are oriented at  $45^\circ$  relative to an orientation direction of fibrous fillers in the second layer of a resin layer.

Page 27, in the paragraph beginning at line 19, please replace as follows:

When an insulating substrate is formed like this, anisotropy in the strength, the linear expansion coefficient and the like of each of the resin layers due to the same orientation direction of fibrous fillers are offset or supplemented by the adjacent resin layers whereby, anisotropy in the properties of an insulating substrate can be alleviated.

Page 27, in the paragraph beginning at line 24, please replace as follows:

Alternatively, in preparing an insulating substrate by laminating a plurality of resin layers as described above, when an angle between orientation directions of fibrous fillers in mutual adjacent resin layers is made to be  $90^\circ$ , anisotropy in the properties of an insulating substrate can be further alleviated effectively. That is, in the resin layers in which fibrous fillers are oriented in the same direction, a great difference in the properties such as the strength, the linear expansion coefficient and the like is observed between this orientation direction and a direction orthogonal to this orientation direction. For this reason, by arranging orientation directions of fibrous fillers in mutual adjacent resin layers at an approximately right angle, anisotropy in the properties can be offset or supplemented effectively and, whereby, anisotropy in the properties of an insulating substrate can be further alleviated.

Page 28, in the paragraph beginning at line 13, please replace as follows:

As described above, in preparing an insulating substrate by laminating a plurality of resin layers, each of the resin layers can be formed by molding a resin composition containing a fibrous filler by injection molding or the like. Alternatively, in obtaining an



insulating substrate by laminating a plurality of mutual resin layers, an insert molding method and a two color molding method can be applied.

Page 28, in the paragraph beginning at line 20, please replace as follows:

First, in molding the first layer of a resin layer, a resin composition in a gate direction, and the composition is solidified to prepare the first layer of a resin layer. In molding the second layer of a resin layer, the first layer of a resin layer is arranged in the other mold, a resin composition is injected in the mold in a gate direction, so as to be laminated on the first layer of a resin layer to obtain the second layer of a resin layer. In an example, a gate direction of the first layer of a resin layer is changed by 90° relative to a gate direction of the second layer of a resin layer at molding, and orientation directions of fibrous fillers in the adjacent first and second layers of the resin layers are arranged at an approximately right angle. Like this, by subjecting resin layers to insert molding successively and changing gate directions (injection direction for a resin composition) successively, resin layers can be laminated to form an insulating substrate.

Page 29, in the paragraph beginning at line 11, please replace as follows:

Alternatively, resin layers are laminated by two color molding, for example, the first resin layer is molded and, thereafter, a mold is turned over and the second layer of a resin layer is molded. In this case, a position of a gate for molding the second layer of a resin layer is arranged so that a gate direction (injection direction of a resin composition) is made to be different from an orientation direction of a fibrous filler in the first layer of a resin layer, preferably at an orthogonal direction.

Page 29, in the paragraph beginning at line 21, please replace as follows:

In the following respective Examples, Reference Examples and Comparative Examples, the plasma treatment was carried out as follows: between electrodes of a plasma

treating apparatus, an insulating substrate is arranged on one of electrodes, a chamber is evacuated to reduced pressure of below  $10^{-4}$  Pa, a  $N_2$  gas and is flown therein and, at the same time, a gas pressure in the chamber is controlled at 10 Pa. A 13.56 Hz high frequency voltage is applied between electrodes for 30 seconds by a high frequency source.

Page 30, in the paragraph beginning at line 5, please replace as follows:

In addition, sputtering is carried out as follows:

By applying the DC sputtering, first, an insulating substrate is arranged in a chamber, and the chamber is evacuated to a pressure of below  $10^{-4}$  Pa with a vacuum pump. In this state, an inert gas such as argon and the like is introduced into the chamber to a gas pressure of 0.1 Pa. Further, by applying a 500 V direct voltage, a copper target is bombarded to form a copper layer having a thickness of 300 nm.

Page 30, in the paragraph beginning at line 17, please replace as follows:

Next, ion plating is carried out as follows: first, a chamber is evacuated to a pressure of below  $10^{-4}$  Pa, and a 10 kV acceleration voltage is applied. Then, an inert gas such as argon or the like is introduced to a gas pressure of 0.1 Pa. In this state, a 200 V bias voltage is applied to an insulating substrate, and a 13.56 MHz high frequency voltage of 500 W is applied to form a copper layer having a thickness of 300 nm.

Page 30, in the paragraph beginning at the last line, please replace as follows:

A resin composition obtained by mixing a base resin and a filler shown in Table 1 at a rate of a filler also shown in Table 1 relative to 100 parts by mass of a base resin was pelletized with an extruder, which was injection-molded to an insulating substrate, 30 mm × 40 mm × 1 mm. This insulating substrate was subjected to the plasma treatment to activate the surface, and, thereafter, a metal layer composed of copper having a thickness of 300 nm by sputtering in Examples 1 and 2 and Comparative Example 1, vacuum deposition in

Examples 3 and 4, and by ion plating in Examples 5 and 6. Then, a circuit was formed by laser method and a circuit-formed part is subject to electrolytic copper plating. Further soft etching treatment was performed to remove the metal of a non-circuit-formed part, as well as to remain the metal of the circuit-formed part, thereby forming a circuit of a desired pattern shape.

Page 31, in the paragraph beginning at line 13, please replace as follows:

Concerning an insulating substrate in this laminate, the linear expansion coefficient was measured in an injection direction for a resin composition and a direction orthogonal thereto at molding of an insulating substrate, anisotropy in the linear expansion coefficient was assessed by placing the linear expansion coefficient in an injection direction for a resin composition at denominator and placing the linear expansion coefficient in a direction orthogonal thereto at numerator.

Page 31, in the paragraph beginning at line 20, please replace as follows:

Concerning thus obtained laminate, the 90° peel strength of the copper plating membrane, which is the circuit for the insulating substrate, was measured for the flowing direction of the resin composition at molding the insulating substrate, and for the direction perpendicular to this direction, and anisotropy in the adherability was assessed by placing the 90° peel strength in an injection direction for a resin composition at denominator and placing the 90° peel strength in a direction orthogonal thereto at numerator.

Page 32, in the paragraph beginning at line 3, please replace as follows:

Next, a circuit is formed on a laminate by a laser method, IC chips were assembled thereon. During the thermal load was applied thereto by retaining at a temperature of 160°C for 1 hour, retaining at a temperature of -40°C for 1 hour, and further reverting to room temperature, the current was supplied to IC chips to operate and, at the same time, output

from IC was observed on an oscilloscope to measure the presence of occurrence of the noises from IC chips.

Page 33, in the first paragraph beginning after the last line of the table, please replace as follows:

As shown in the Table, in Examples 1 to 6 as compared with Comparative Example 1, the linear expansion coefficient of an insulating substrate is lower and the adherability between an insulating substrate and a metal layer is higher and, occurrence of the noises from a packaged parts was not perceived.

Page 33, in the paragraph beginning at line 8, please replace as follows:

A resin composition obtained by mixing a base resin and a filler shown in Table 2 at a rate of a filler also shown in Table 2 relative to 100 parts by mass of a base resin was pelletized with an extruder, which was injection- molded to an insulating substrate, 30 mm × 40 mm × 1 mm. This insulating substrate was subjected to the plasma treatment to activate the surface and, thereafter, a metal layer composed of copper having a thickness of 300 nm was formed by sputtering. Then, a circuit was formed by laser method and a circuit-formed part is subject to electrolytic copper plating. Further soft etching treatment was performed to remove the metal of a non-circuit-formed part, as well as to remain the metal of the circuit-formed part, thereby forming a circuit of a desired pattern shape.

Page 33, in the paragraph beginning at line 20, please replace as follows:

Concerning thus obtained laminate, the 90° peel strength of the copper plating membrane, which is the circuit for the insulating substrate, was measured. Concerning a laminate which had received the thermal load at 160°C for 2 hours immediately after formation of a metal layer, the 90° peel strength was measured. The measurement results are shown in Table 2.

Page 34, in the paragraph beginning at line 2 after the last line of Table 2, please replace as follows:

A resin composition obtained by mixing a base resin and a filler shown in Table 3 at a rate of a filler also shown in Table 3 relative to 100 parts by mass of a base resin was pelletized with an extruder, which was injection-molded to an insulating substrate, 30 mm × 40 mm × 1 mm. This insulating substrate was subjected to the plasma treatment to activate the surface and, thereafter, a metal layer composed of copper having a thickness of 300 nm was formed by sputtering. Then, a circuit was formed by laser method and a circuit-formed part is subject to electrolytic copper plating. Further soft etching treatment was performed to remove the metal of a non-circuit-formed part, as well as to remain the metal of the circuit-formed part, thereby forming a circuit of a desired pattern shape.

Page 35, in the paragraph beginning at line 5, please replace as follows:

Concerning thus obtained laminate, the 90° peel strength of the copper plating membrane, which is the circuit for the insulating substrate, was measured for the flowing direction of the resin composition at molding the insulating substrate and for the direction perpendicular to this direction. In addition, concerning a laminate which had received the thermal load at 160°C for 2 hours immediately after formation of a metal layer, the 90° peel strength was measured. The measurement results are shown in Table 3. When the same sample to that of Comparative Example 2 is not subjected to the plasma treatment, the peel strength could not be measured because a plated membrane had been peeled.

Page 35, in the paragraph beginning at line 19 (line 1 after the last line of Table 3), please replace as follows:

As shown in the Table, it was confirmed that, by using a melt-type liquid crystal polyester as a base resin and using a fibrous filler having an average fiber diameter of 0.3 to

0.6  $\mu\text{m}$  and an average fiber length of 10 to 20  $\mu\text{m}$  as a fiber, the adherability between an insulating substrate and a metal layer was improved.

Page 36, in the paragraph beginning at line 3, please replace as follows:

A resin composition obtained by mixing a base resin and a filler shown in Table 4 at a rate of a filler also shown in Table 4 relative to 100 parts by mass of a base resin was pelletized with an extruder, which was injection-molded to an insulating substrate, 30 mm  $\times$  40 mm  $\times$  1 mm. This insulating substrate was subjected to the plasma treatment to activate the surface and, thereafter, a metal layer composed of copper having a thickness of 300 nm was formed by sputtering. Then a circuit was formed by laser method and a circuit-formed part is subject to electrolytic copper plating. Further soft etching treatment was performed to remove the metal of a non-circuit-formed part, as well as to remain the metal of the circuit-formed part, thereby forming a circuit of a desired pattern shape.

Page 36, in the paragraph beginning at line 14, please replace as follows:

Concerning the thus obtained laminate, the 90° peel strength of the copper plating membrane, which is the circuit for the insulating substrate, was measured for the flowing direction of the resin composition at molding the insulating substrate and for the direction perpendicular to this direction. In addition, concerning a laminate which had received the thermal load at 160°C for 2 hours immediately after formation of a metal layer, the 90° peel strength was measured. The measurement results are shown in Table 4.

Page 37, in the paragraph beginning at line 1 after the last line of Table 4, please replace as follows:

As shown in the Table, it was confirmed that, by using poly(phthalamide) with polyphenylene sulfide added, the adherability between an insulating substrate and a metal layer was improved as compared with the case of poly(phthalamide) alone.

Page 37, in the paragraph beginning at line 6 after the last line of Table 4, please replace as follows:

A resin composition obtained by mixing a base resin and a filler shown in Table 5 at a rate of a filler also shown in Table 5 relative to 100 parts by mass of a base resin was pelletized with an extruder, which was injection-molded to an insulating substrate, 30 mm × 40 mm × 1 mm. This insulating substrate was subjected to the plasma treatment to activate the surface and, thereafter, a metal layer composed of copper having a thickness of 300 nm was formed by sputtering. Then, a circuit was formed by laser method and a circuit-formed part is subject to electrolytic copper plating. Further soft etching treatment was performed to remove the metal of a non-circuit-formed part, as well as to remain the metal of the circuit-formed part, thereby forming a circuit of a desired pattern shape.

Page 37, in the paragraph beginning at the last line, please replace as follows:

Concerning the above insulating substrate, the linear expansion coefficient was measured in an injection direction for a resin composition and a direction orthogonal thereto at molding of an insulating substrate, an anisotropy of the linear expansion coefficient was assessed by placing the linear expansion coefficient in an injection direction for a resin composition at denominator and placing the linear expansion coefficient in a direction orthogonal thereto at numerator.

Page 38, in the paragraph beginning at line 7, please replace as follows:

In addition, concerning the thus obtained laminate, the 90° peel strength of a metal layer relative to an insulating substrate immediately after formation of a metal layer in an injection direction for a resin composition at molding of an insulating substrate and a direction orthogonal thereto was measured, and anisotropy of the adherability was assessed

by placing the 90° peel strength in an injection direction for a resin composition at denominator and placing the 90° peel strength in a direction orthogonal thereto at numerator.

Page 38, in the paragraph beginning at the last line, please replace as follows:

As shown by the Table, it was confirmed that, in Example 20 in which only aluminium borate as a fibrous filler was used as a filler, assessment of anisotropy in the linear expansion coefficient was 2.2 and assessment of anisotropy in adherability was 1.16, while, in Example 21 in which silica as a spherical filler was used as a filler in addition to aluminium borate as a fibrous filler, assessment of anisotropy in linear expansion coefficient was 0.96 and assessment of anisotropy in adherability was 1.0 and, thus, anisotropy was greatly alleviated.

Page 39, in the paragraph beginning at line 9, please replace as follows:

A resin composition obtained by mixing a base resin and a filler shown in Table 6 at a rate of a filler also shown in the Table 6 relative to 100 parts by mass of a base resin was pelletized with an extruder, which was injection-molded to an insulating substrate, 30 mm × 40 mm × 1 mm. This insulating substrate was subjected to the plasma treatment to activate the surface and, thereafter, a metal layer composed of copper having a thickness of 300 nm was formed by sputtering. Then, a circuit was formed by laser method and a circuit-formed part is subject to electrolytic copper plating. Further soft etching treatment was performed to remove the metal of a non-circuit-formed part, as well as to remain the metal of the circuit-formed part, thereby forming a circuit of a desired pattern shape.

Page 39, in the paragraph beginning at line 20, please replace as follows:

Concerning the above insulating substrate, anisotropy in the linear expansion coefficient and adherability was assessed as in Examples 20 and 21.

Page 40, in the first line, please change as follows:



## Table 6

Page 40, in the first line after the last line of Table 6, please replace as follows:

As shown by the Table, it was confirmed that, in Example 23 in which only wallastonite as a fibrous filler was used as a filler, assessment of anisotropy in the linear expansion coefficient was 1.5 and assessment of anisotropy in adherability was 1.25, while, in Example 24 in which kaolin as an unshaped powdery filler was used as a filler in addition to wallastonite as a fibrous filler, assessment of anisotropy in the linear expansion coefficient was 1.0 and assessment of anisotropy in the adherability was 1.0 and, thus, anisotropy was greatly alleviated.

Page 40, in the paragraph beginning at line 10, please replace as follows:

A resin composition obtained by mixing a base resin and a filler shown in Table 7 at a rate of a filler also shown in Table 7 relative to 100 parts by mass of a base resin was palletized with an extruder, which was injection-molded to an insulating substrate, 30 mm × 40 mm × 1 mm. This insulating substrate was subjected to the plasma treatment to activate the surface and, thereafter, a metal layer composed of copper having a thickness of 300 nm was formed by sputtering. Then, a circuit was formed by laser method and a circuit-formed part is subject to electrolytic copper plating. Further soft etching treatment was performed to remove the metal of a non-circuit-formed part, as well as to remain the metal of the circuit-formed part, thereby forming a circuit of a desired pattern shape.

Page 41, in the paragraph beginning at line 5, please replace as follows:

In addition, concerning the above insulating substrate, the linear expansion coefficient was measured in an injection direction for a resin composition at molding of an insulating substrate.

Page 41, in the paragraph beginning at line 8, please replace as follows:

In addition, concerning the thus obtained laminate, the 90° peel strength of the copper plating membrane, which is the circuit for the insulating substrate, was measured for the flowing direction of the resin composition at molding the insulating substrate.

Page 41, in the paragraph beginning at line 12, please replace as follows:

In addition, after a circuit was formed on a laminate by a laser method, IC chips were assembled thereon, which was retained at a temperature of 160°C for 1 hour, retained at a temperature of -40°C for 1 hour and, further, reverted to room temperature and, thereafter, the presence of the noises from IC chips was measured.

Page 42, in the paragraph beginning at line 1, please replace as follows:

As shown by the Table, it was confirmed that when the amount of a fibrous filler is below 20 parts by mass, it tends to increase in the linear expansion coefficient and occurrence of the noises from IC chips and, in Comparative Example 4, when the amount exceeds 150 parts by mass, a pellet was not obtained at molding, and thus a laminate could not be molded. In addition, it was confirmed that the better adherability and the linear expansion coefficient can be obtained.

Page 42, in the paragraph beginning at line 9, please replace as follows:

A resin composition obtained by mixing a base resin and a filler shown in Table 8 at a rate of a filler also shown in Table 8 relative to 100 parts by mass of a base resin was pelletized with an extruder, which was injection-molded to an insulating substrate, 30 mm × 40 mm × 1 mm. This insulating substrate was subjected to the plasma treatment to activate the surface and, thereafter, a metal layer composed of copper having a thickness of 300 nm was formed by sputtering. Then, a circuit was formed by laser method and a circuit-formed part is subject to electrolytic copper plating. Further soft etching treatment was performed to